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RETURN TO NATURE: THE ROLE OF SCHOOL GARDENS IN EDUCATION AND HUMAN WELL-BEING

INTRODUCTION

Humans are living organisms, a fact that has never been questioned. Nevertheless, within our minds and cultures, we have begun to divide the environment into what is human-made and what is nature-made. We have learned to distinguish between phenomena that belong to nature and those that belong to culture. We also tend to perceive ourselves as a special kind of organism – one that has the right to decide about all other living creatures – and, as a result, we are becoming increasingly disconnected from nature. A growing body of research shows that in modern societies, children spend significantly less free time in nature than they did only a few decades or even years ago (Soga & Gaston, 2016). Pyle (1993) was the first to coin the term *extinction of experience*, which describes the ongoing and increasing alienation of humans from nature. He argued that this phenomenon is not just about losing the personal benefits of nature – what he calls the *natural high* – but also about triggering a cycle of disaffection that can have disastrous consequences. Pyle emphasized that direct, personal contact with nature is essential for developing emotional intimacy with the natural world, and that this connection cannot be replaced by vicarious experiences. The review conducted by Soga and Gaston (2016) indicates that the loss of interaction with the natural environment has many negative effects.

These range from reduced health and well-being benefits to a decline in positive emotions, attitudes, and behaviors toward nature, potentially creating a cycle of growing disconnection. As children spend less time outdoors, nature becomes increasingly external to their experience. Soga and Gaston warn that this loss of experience is not just about missing out on knowledge but also about losing emotional connection and motivation to care (Soga & Gaston, 2016). They argue that people place less value on nature when they no longer see, touch, or interact with it. This presents a serious problem for environmental education, which depends on students not only understanding ecological issues but also feeling that they matter enough to motivate action. These implications highlight the importance of reconnecting people with nature and underscore the need for further research and public policy to address and raise awareness of the *extinction of experience* – also within school settings. This article examines school gardening, its educational significance, and its potential to foster emotional connection and attentiveness toward plants.

At the same time, it is well established that spending time in nature during childhood supports both mental and physical health, enhances academic achievement, and fosters pro-environmental attitudes and behaviors. Increasing outdoor experiences during school hours can strengthen these benefits and make them accessible to all students. However, in practice, incorporating outdoor time into the school day can be challenging. Patchen et al. (2024), in their in-depth semi-structured interviews and focus groups with educators, identified 33 barriers that limit outdoor learning during school hours. These include time constraints, classroom management issues, the tendency to treat outdoor time as a reward rather than as an integral part of instruction, student distraction, lack of administrative and policy support, and limited access to appropriate materials or teaching contexts. A teaching context that restricts outdoor and hands-on experiences with nature may inadvertently reinforce a phenomenon known as *plant blindness*, by reducing students' opportunities to observe, interact with, and appreciate plants as integral components of living systems. *Plant blindness* refers to the tendency to overlook or undervalue plants in our surroundings (Parsley, 2020; Wandersee & Schussler, 1999). Over time, a clear pattern has emerged in which plants are underappreciated relative to animals. Even though the scientific value of plants to ecosystems is widely recognized, from providing organic matter and oxygen to their roles in complex interspecies interactions, climate change mitigation, and public health (Ziska et al., 2009), plants are often marginalized in education and beyond. This has contributed to what was originally termed *plant blindness*, describing a failure to notice plants, to recognize their importance, to appreciate their beauty and uniqueness, and a tendency to regard them as less valuable than animals (Wandersee & Schussler, 1999). More

recently, the term *plant awareness disparity* (PAD) has been proposed as a more inclusive and less biased alternative to describe this tendency to overlook plants or undervalue their significance (Parsley, 2020).

Neglecting plant life harms plants themselves, but also the wider web of life. When education sidelines plants in curricula, it overlooks the organisms that structure ecosystems and shape the planet's sustainability (Bobo-Pinilla et al., 2024). Stagg and Dillon, in their literature review (2022), examined the human-plant relationship and the characteristics of PAD in the educational context, where their key finding was that school curricula and textbooks privilege animals over plants, and research on plant awareness focused on knowledge deficits, neglecting the affective dimensions of plant learning. In addition, Stagg, Hetherington, and Dillon (2025) argued that plant biology education research still focuses on species-identification and classroom routines, with limited attention to affective learning; they propose a model linking perceptual attention, interest, attitudes, and learning, and show that memorable first-hand encounters with plants that generate positive affect are most effective for increasing plant awareness.

This limited awareness has important educational consequences, as it reduces children's understanding of ecological relationships and their sense of connection with the living world. Addressing plant blindness through hands-on experiences such as school gardening may help restore children's attention to plants, foster empathy toward living organisms, and strengthen ecological literacy from an early age.

An additional issue is that gardens and gardening has been part of our culture and connection with nature. Research links community/ethnobotanical gardens with biocultural diversity, showing how gardens conserve plant varieties and traditional ecological knowledge (TEK) while sustaining community identity (Gao & Dietze-Schirdewahn, 2018). Swensen et al. (2022) in their study analyzed and described how cultural heritage, combined with urban gardening, can serve as a means of revitalizing areas in need of renewal. Especially in culturally diverse neighborhoods, urban gardening can connect visions of social and physical well-being with urban regeneration. The authors emphasize that providing adequate and easily accessible green public spaces is essential for creating healthy environments. Gardens are becoming also more useful in educational settings. The idea of garden-based learning (GBL) or garden-based approach was created, which can be defined as an instructional strategy that utilizes a garden as a teaching tool (Fisher-Maltese & Zimmerman, 2015).

More recent research situates gardening within the traditions of experiential and place-based learning, showing how reconnecting children, particularly those in urban areas, with natural systems fosters ecological literacy and addresses the loss of connection to nature often described as "nature deficit" (Blair, 2009). These

studies emphasize personal engagement, learning by doing, and the interactions between learning, place, and culture. Insights from experiential and place-based learning further suggest that culture emerges dynamically as people collectively organize food systems within a continually evolving perception of place, which provides a strong rationale for incorporating gardening into educational practice. This fluid and interwoven sense of place shapes how individuals seek food, adapt to their environment, and construct the cultural values and worldviews that arise from these processes (Stroink et al., 2010).

The emerging trend toward valuing activities in natural environments appears not only pedagogically appropriate but also scientifically substantiated. A growing body of research supports this view, which we aim to present in this article. There is also research examining the barriers that prevent or limit the amount of time schoolchildren spend in nature. For example, studies show that teachers often report a lack of curriculum connections to outdoor learning as a major obstacle to implementing it (Patchen et al., 2024). Kozłowska et al. (2025) described in their findings that classes in school gardens are most often conducted at early educational stages – in kindergartens and lower primary grades – and mainly by teachers of science-related subjects. Teachers of humanities and social sciences use school gardens extremely rarely. Among the factors influencing the frequency of garden use, respondents indicated financial constraints and insufficient knowledge about how to conduct outdoor lessons. This also highlights the important role of teachers' competencies in outdoor education. One way to address this gap could be through activities such as school gardening. Blair (2009), in her comprehensive review of U.S. research on the outcomes of school gardening programs, found that gardening had positive effects on academic achievement in science and nutrition education, as well as on children's food preferences (e.g., a greater willingness to eat vegetables). However, she also reported mixed results regarding environmental attitudes, social behavior, and self-esteem. Since her review, new evidence has emerged that further underscores the educational potential of gardening. In this article, we present arguments and a model for introducing (or reintroducing) gardening into classroom practice, supported by theoretical perspectives from pedagogy, biology, and the cognitive sciences, from the evidence we have now. We might say that gardening enhances personal and social well-being, reducing stress and improving mood while fostering belonging, collaboration, and community cohesion (Soga et al., 2017).

The summary of the major current problems that lead to a garden-based approach in education is shown in Figure 1.

Figure 1

The summary of the main current challenges that have led to the development of a garden-based approach in education

Note. Source: own work.

ARGUMENTS FOR INTRODUCING A GARDENING-BASED APPROACH INTO SCHOOLS

The article aims to present arguments supporting the reintroduction of gardening into school activities, including its integration into the core curriculum. Drawing on pedagogical, psychological, and biological research, we highlight evidence demonstrating the importance of contact with plants and gardening for children's cognitive and emotional development. Although in recent years we have seen a growing interest in forest kindergartens and nature-based learning, these remain largely local and non-systemic initiatives. Finally, based on a holistic educational model (Rybska & Błaszak, 2020), we also offer a set of project guidelines for educators who would like to introduce gardening into schools.

ARGUMENTS FROM BIOLOGICAL SCIENCES

The phenomenon of the need to connect people with nature was described in many articles. The human *biophilia hypothesis* (Kellert & Wilson, 1993; Wilson, 1984) states that as living organisms, we have "the need to feel a connection with

other living organisms." Wilson (1984) argues that living beings have an innate sense of affiliation with the natural world, which is essential for our proper development as individuals. Additionally, nature has a positive effect on our balance and calmness, helps restore the desired equilibrium, and supports concentration (Kellert & Wilson, 1993; Wilson, 1984). The interest in the research on the influence of nature on human health has not been studied widely in the 20th century. One of the first was Ulrich (1984), who, in his pioneering research on the restorative effects of nature on the human body, found that a faster recovery process in patients who had undergone surgery could occur when they had the opportunity to look out at a green landscape rather than a brick wall while resting in their hospital room. It can be argued that people surrounded by nature not only feel healthier and safer but also tend to behave more in accordance with accepted social norms. This claim is supported by the findings of Kuo and Sullivan (2001), who showed that nature can reduce levels of criminal behavior by activating local communities and eliminating the psychological precursors of violence.

Sumitomo et al. (2015) collected blood samples of participants after a 60min-forest walk, and found out that they contained a-pinene, a monoterpene (fragrant molecule) that derives from conifers with anti-inflammatory and anti-cancer effects, but can also slow the enzyme acetylcholinesterase by binding the enzyme-substrate complex, and this same kind of reversible enzyme blocking is what some Alzheimer's medications target to slow symptom progression. In a similar vein, Hoult et al. (2019), reported that peppermint essential oil aroma may affect thinking processes and mood in healthy young adults, for instance fast word recall, and that the duration of the exposure is crucial for long-term memory benefits. This points to a key takeaway for schools: gardens and natural scents can foster a clearer thinking, shift student's mood, and have a positive impact on their overall health and wellbeing.

ARGUMENTS FROM COGNITIVE SCIENCES

According to the Attention Restoration Theory, green spaces surrounding schools, recreational areas, and homes are crucial for social well-being in modern society (Li & Sullivan, 2016). The findings of Li and Sullivan (2016) suggest that high school students perform better on tests when they are in classrooms with views of green landscapes, compared to those without windows or with views of built environments, and these differences are statistically significant. Dadvand et al. (2015) demonstrated an association in which the amount of greenery surrounding a home and school correlated with improvements in cognitive development, specifically, greater progress in working memory and reduced inattentiveness, among school-aged children.

In a pilot intervention study that combined community gardening and education about nutrition and healthy eating, it was also shown that overweight and obese children improved their body mass index by the end of the seven-week intervention program (Castro et al., 2013). Soga's et al. (2017) systematic review about the health outcomes related to gardening revealed significant positive effects of gardening on various health outcomes, including reductions in depression and anxiety, improvements in life satisfaction, quality of life, and sense of community.

Shao et al. (2020) showed in their study that the impact of horticultural activities on children compared to using smartphones is much greater in terms of physiological and psychological measurements. In particular, the authors conducted an experiment where children were asked to perform a horticultural activity (cut stems of a plant and cultivate them in pots) and play a game of simulation of gardening on smartphones, both lasting for 5 minutes, revealing, among others, that children were more relaxed during the horticultural activity, showing lower skin conductance (sweating), and feeling comfortable and cheerful (Shao et al., 2020). Similarly, Kim et al. (2021), using an electroencephalograph in their study, found that participants showed higher concentration and stronger brain activation during harvesting, and they felt more positive during horticultural activities than during non-horticultural ones. Thus, brief, hands-on gardening helps children settle and feel better than a quick screen task. It also sharpens attention and task-related brain activities, making school gardening an easy way to help students feel calmer and think more clearly.

ARGUMENTS FROM PEDAGOGICAL SCIENCES

The idea of incorporating gardening into the school setting is not new. We chose some key examples that shaped school-garden pedagogy. Pestalozzi (1801/1894) argued that to teach a child about plants, it isn't helpful to send them into the field, but to begin with guided encounters and careful observation that help the child understand and notice features and relationships. As the originator of the kindergarten concept, Fröbel (1826/1903) advocated that gardening belongs at the heart of schooling. He claimed it helps a lot for children to have their own small gardens and grow things. This lets them see their work lead to real results that follow nature's rules but also depend on their care. Gardening strengthens their connection to nature and keeps them watching plants closely; even basic care makes plants grow, and careful care makes them flourish. He adds that caring for plants teaches children to care for themselves and others, too (Fröbel, 1826/1903).

Dewey (1915) later framed gardening and kitchen work as meaningful 'occupations' that lead children into real science, asking where plants grow, what they need, and how soil and climate matter, rather than listing plant parts out of context. He advocated for plant study in the natural environment and in relation to human use, linking growth, ecology, and social life. Last but not least, while we do not adopt Montessori's hierarchical framing that places 'civilization' above 'nature,' we acknowledge her influence on land-based experiential approaches within this tradition, with her educational reform. Her *Erdkinder* (land-children) essay argues that adolescent learning should center on work on the land because farming links health and social-economic life (production and exchange), and improves physical health (Montessori, 1948/1949/2007).

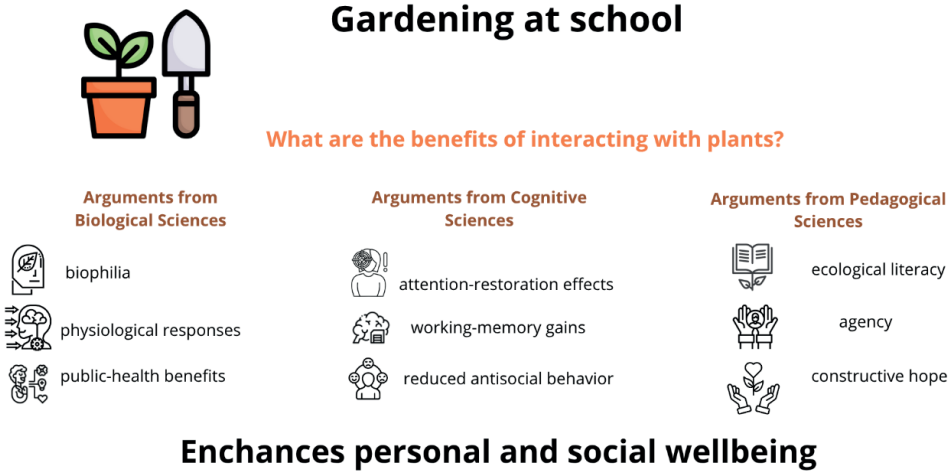
Gardening also enhances ecological literacy. In fact, the essence of experiential learning through school gardens is helping learners to become environmentally literate (Dahl & Cushing, 2022). Environmental literacy has five components, which are awareness, knowledge, attitude, skill, and behavior (Coyle, 2005). Hammarsten and co-workers (2019) showed increased ecological literacy among children who participated in forest gardening. Participants in their research expressed strong positive feelings about the forest garden, both regarding the organized and spontaneous activities that took place there and their experiences of caring for the organisms living in it. Among the observed aspects of learning that were potentially beneficial for the development of children's ecological literacy were practical competence, learning how to coexist and care, as well as biological knowledge and ecological understanding. Dahl and Cushing, (2022) in their research showed that a hands-on garden-based outdoor education program can increase environmental literacy in elementary school children with a low-income background. The participants particularly improved their pro-environmental awareness, attitude, and behavior, which are elements of environmental literacy.

For children, especially early interactions with nature can help establish this emotional foundation. Chawla's review highlights that forming a positive bond with nature from a young age is vital for developing what Ojala (2016) calls "constructive hope": the belief that, even when facing serious environmental challenges, children can still think they can make a difference (Chawla, 2020). In this context, cultivating hope can be multidimensional: helping students reframe challenges positively, explore issues they care about, build agency, connect with others working for nature, and develop comfort and kinship with the natural world (Chawla, 2020).

The summary of the main arguments for introducing a gardening-based approach into schools are presented in Figure 2.

Figure 2

The summary of the main arguments for introducing a gardening-based approach into schools



Note. Source: own work.

HOLISTIC EDUCATION PARADIGM – A POSSIBLE MODEL FOR INCORPORATING GARDENING INTO SCHOOLS

There are many approaches to introducing gardening into schools. As mentioned above, most research situates gardening within experiential and place-based learning. These studies emphasize the use of tools, hands-on activities, and learning by doing; they focus on developing a connection to place, making activities meaningful and authentic, and offering a learning environment different from the traditional classroom (Ruiz-Gallardo et al., 2013). In this article, we build on these perspectives and propose a gardening-based approach grounded in a holistic model of education, in which elements such as embodied cognition are integrated with values. Rybska and Błaszak (2020) outline a modular model of holistic education for teaching built on three interacting dimensions linked to major brain networks (salience, central executive, default mode): i) *sensibility*, providing, among others, safety, belonging, and comfort, ii) *functionality*, empowering cognitive functions, and iii) *rationality*, with a reflection on values, imagination, and creativity. They suggest ways that such can be implemented in the classroom setting, for instance, presenting personal achievements as an activity to support sensibility, multimodal learning, adapting multisensory approaches to strengthen functionality, and taking care of a plant as a personal fulfilment to enhance rationality (Rybska & Błaszak, 2020). In a school garden, this model would become tangible: sensibility in safety

and belonging, functionality in hands-on, multisensory work, and rationality in reflecting on values and creativity while caring for plants.

Błaszak et al. (2019) propose designing *useful botanical gardens* that align senses, emotions, and cognition through sensibility, functionality, and rationality. Experiences in a botanical garden can engage all three networks in complementary ways. The salience network (sensibility) is sparked by new smells, colours, and textures, which catch feelings and attention; the central executive network (functionality) is used for clear tasks which build focus and give a sense of achievement with affordances (the actions the place allows) making learning hands-on: students can smell herbs, touch soil and leaves, taste edible fruits, harvest, and water plants; and the default mode network (rationality) supports quiet moments to connect experiences with ideas, values, and imagination; short breaks in green spaces also help minds reset (Błaszak et al., 2019). Thus, a well-planned garden builds practical skills and emotional engagement, encourages teamwork, communication, and creativity, makes big topics, like climate change or fair use of water and energy, easier to discuss, and teachers can co-design these spaces with psychologists, cognitive scientists, architects, biologists, and botanists to make them truly socially useful for the school (Błaszak et al., 2019).

Drawing on their model of holistic education, we provide illustrative examples of classroom activity features that support teaching and learning about, in, and through gardening (Table 1).

Table 1

Illustrative examples of classroom activity features for Holistic Education for teaching/learning about, in, and through gardening

Dimension of Holistic Education	Design features	Examples of activity features that support this dimension
Sensitivity (safety, inclusion, participation)	– Multisensory stations (touch-smell-look): herbs for scent, fuzzy leaves, soil textures; quiet "listening corners" – Clear physical affordances: clear paths, shaded rest spots, water access, benches for resting arranged in circles or semi-circles, maybe created from a dead tree Major task for teacher: create "zones for comfort" – pleasant, low-stress green spaces that restore attention and invite engagement	– Short-term task: "Sensory transect" students rotate through smell/touch/look posts and journal immediate sense data (words, sketches), increasing perception, attention – Long-term task: "Garden roles board": every student has an equitable micro-role (water keeper, soil tester, tool steward), increasing belonging and participation – Long-term task: "My favourite tree is going through changes": every learner selects a tree of their choice and documents seasonal changes, but also documents the role of a tree for other organisms like birds, spiders, etc.
Functionality (interaction, cognition, representation)	– Problem-based stations with prompts (e.g., "Why do these leaves at the lower part of the tree have bigger surface area than the ones on the top of the tree?") – Multimodal tasks/ multimodal representation stations: clipboards for drawings, sheets for notes, tools for simple graphs; anchor charts with verbs for scientific practices (observe/ measure/ model/explain) Major task for teacher: create zones for inquiry – build prompts, driving questions, and interactive affordances that move visitors into flow	– "Micro-investigation": pupils are asked to design and run a 20-minute fair test (e.g., measure a temperature in different places: in shade vs. on the sun-soil), then they need to plot graphs and share claims that are supported by evidence. Then they can infer what these mean for the gardener, what plants will be best suited for the spots they examined – "Model the bed": students construct 2D/3D models of their garden bed (from paper, string, blocks) showing spacing, sun path; then plant the seeds, iterate after observing and documenting real growth – "Representation relay": the groups create different modes of representations of objects of phenomena in the garden, and build together the representational chain, e.g., group A sketches leaf types, group B converts it to a table, group C to a bar chart, group D writes a one-sentence claim from the graph – explicit translation across representations. Discussions on which mode is best suited to which purpose – "Walk in Somebody's Shoes" – What is it like to be a fern, butterfly, spider, or mushroom? Students imagine themselves as one of these organisms and reflect on questions such as: *What do I need to survive? What am I afraid of? Who is my ally?* Then they choose their preferred mode of presentation, e.g., an essay, a short drama, or a drawing

Rationality (values, imagination, creativity)	– Reflection prompts that link gardening to values (care, fairness, loyalty, authority, sanctity, liberty): e.g., "What is a fair way to share harvest?" "How do we show care for soil organisms?" "Are we responsible for the plants?" – Storying & futurecasting corners (autobiographical memory, empathy, ethical reasoning) – open-ended choice-based creation: design a mini-bed for pollinators/heritage plants/edibles with a value statement Major task for teacher: create zones of reflection – curate experiences that provoke reflection on values (care, fairness, etc.) tied to environmental stewardship	– "Ethics of harvest": small groups negotiate a harvest charter (care/fairness), balancing class needs and wildlife; present rationale (based on the well-known common pasture problem) – "Soil citizenship": students create metaphor maps (soil as 'city of organisms') and discuss authority/responsibility in taking care of it – "Garden narratives": write or record a short first-person plant diary linking growth stages to human moods/decisions; share in a circle to build empathy and meaning. Or write an elegy for a dead tree, or an essay on a question: Would you cry more for a dead fox or a dead tree? – The reflective observer tasks: students are asked to first observe nature, document their observation, and then prepare an argument on *what values nature can teach us?* Or *is nature a good teacher? Are we embedded more in nature than in culture?*

Note. Source: own work.

CONCLUSION

By invoking a "return to nature," we do not endorse the culture-nature dualism, nor the idea of a pristine, untouched nature that exists beyond us. Following Cronon (1996), framing nature as something "out there" allows people to avoid responsibility for their daily impact on the environment. Integrating an approach that views nature and culture as interconnected emphasizes sustainable relationships with all environments rather than maintaining an unrealistic divide between the "wild" and the human world (Cronon, 1996). Thus, returning to nature through education is about deepening our understanding of how inseparably human life is tied to the natural world, and recognizing that caring for the environment means caring for people, plants, animals, and the places we share.

Reintroducing gardening into schools is an evidence-based way to repair children's ties to living systems while improving both learning and well-being. School gardens directly counter *plant awareness disparity* by giving students regular, meaningful encounters with plants, cultivating not only knowledge about them, but also positive feelings and attentiveness that motivate care.

Biologically, gardening offers many benefits: it improves mood, enhances concentration, and fosters calmness (Kellert & Wilson, 1993; Wilson, 1984). Even brief exposures matter, hands-on horticultural activities positively affect students' learning, and natural plant scents can enhance attention and recall (Hoult et al., 2019; Shao et al., 2020; Sumitomo et al., 2015). Cognitively, green views and outdoor tasks are associated with restored attention, gains in working memory, and increased task-focused brain activity (Dadvand et al., 2015; Kim et al., 2021; Li & Sullivan, 2016).

Pedagogically, gardens provide opportunities ranging from guided, concrete observation and manual work to meaningful 'occupations' that connect school, inquiry, and community (Dewey, 1915; Fröbel, 1826/1903; Pestalozzi, 1801/1894). Contemporary programs extend this tradition by fostering ecological literacy and constructive hope through place-based, hands-on learning, while acknowledging the real barriers teachers face in making outdoor learning a routine part of school life (Blair, 2009; Chawla, 2020; Dahl & Cushing, 2022; Hammarsten et al., 2019; Patchen et al., 2024).

A practical way forward is to integrate gardening within a holistic education framework, one that supports sensibility (safety, belonging), functionality (inquiry and representation), and rationality (values, imagination), so that students learn *about*, *in*, and *through* the garden (Błaszak et al., 2019; Rybska & Błaszak, 2020). When aligned with curriculum, policy, and teacher development, gardens can become an ordinary part of school life rather than an exception, linking care for plants with clearer thinking, steadier moods, and a broader sense of responsibility for the environments we share.

Williams and Brown (2012) rightly point out that, in today's Western culture, we often privilege "thinking" and overlook the body's role in learning. Reawakening the senses brings students into the present and opens awareness of the many, layered connections among living things, and school gardens offer an easy, nearby place to practice this, sharpening perception and inviting fuller engagement with life (Williams & Brown, 2012).

In essence, gardens are not only spaces for calm and restoration but also serve as pedagogical tools, learning environments, and lesson content. Most importantly, they provide a unique opportunity to foster a meaningful connection with nature. Therefore, gardening should occupy a special place in both the school curriculum and everyday school life.

Authors' statement
We used ChatGPT (OpenAI) for grammar and style edits.

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Authors: Zacharoula Antoniou and Eliza Rybska
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Summary

The article argues for (re)introducing school gardening as a systematic component of education – embedded in the core curriculum – because it supports children's cognitive, emotional, social, and health outcomes while counteracting *plant awareness disparity.* After outlining the problem of declining child–nature contact and the educational risks of plant blindness, the paper synthesizes historical pedagogical arguments (Pestalozzi, Fröbel, Dewey, Montessori) with contemporary evidence from biology, cognitive science, and pedagogy. From the biological sciences, the paper highlights *biophilia*, restorative and public-health benefits of nature exposure (e.g., recovery, reduced crime

correlates), and specific findings on forest volatiles and physiological responses. From cognitive sciences, it reviews attention-restoration effects of green views, associations between urban greenery and working-memory gains, and experimental evidence that brief hands-on horticulture improves affect and attentional activation more than screen-based analogues. From pedagogy, it frames gardening as experiential and place-based learning that nurtures ecological literacy, agency, and "constructive hope," while noting systemic barriers that suppress outdoor learning (e.g., time, assessment alignment, policy/safety constraints).

As a practical response, the paper proposes implementing gardening through a Holistic Education Model (sensibility–functionality–rationality), mapping each dimension to classroom and garden design features and to concrete learning activities (e.g., multisensory "sensory transects," rapid investigations with data visualization, ethical harvest charters, narrative reflection). This model operationalizes gardening as learning about, in, and through nature. The article concludes that gardening is a scientifically substantiated, equity-minded approach to rebuild children's connection with plants, strengthen inquiry-rich science learning, and foster wellbeing, provided curricula, school policies, and teacher development align to make outdoor learning a routine rather than exceptional.